Solar-Powered Car Control System
Zilog/Circuit Cellar Contest
Enter Number ez2945

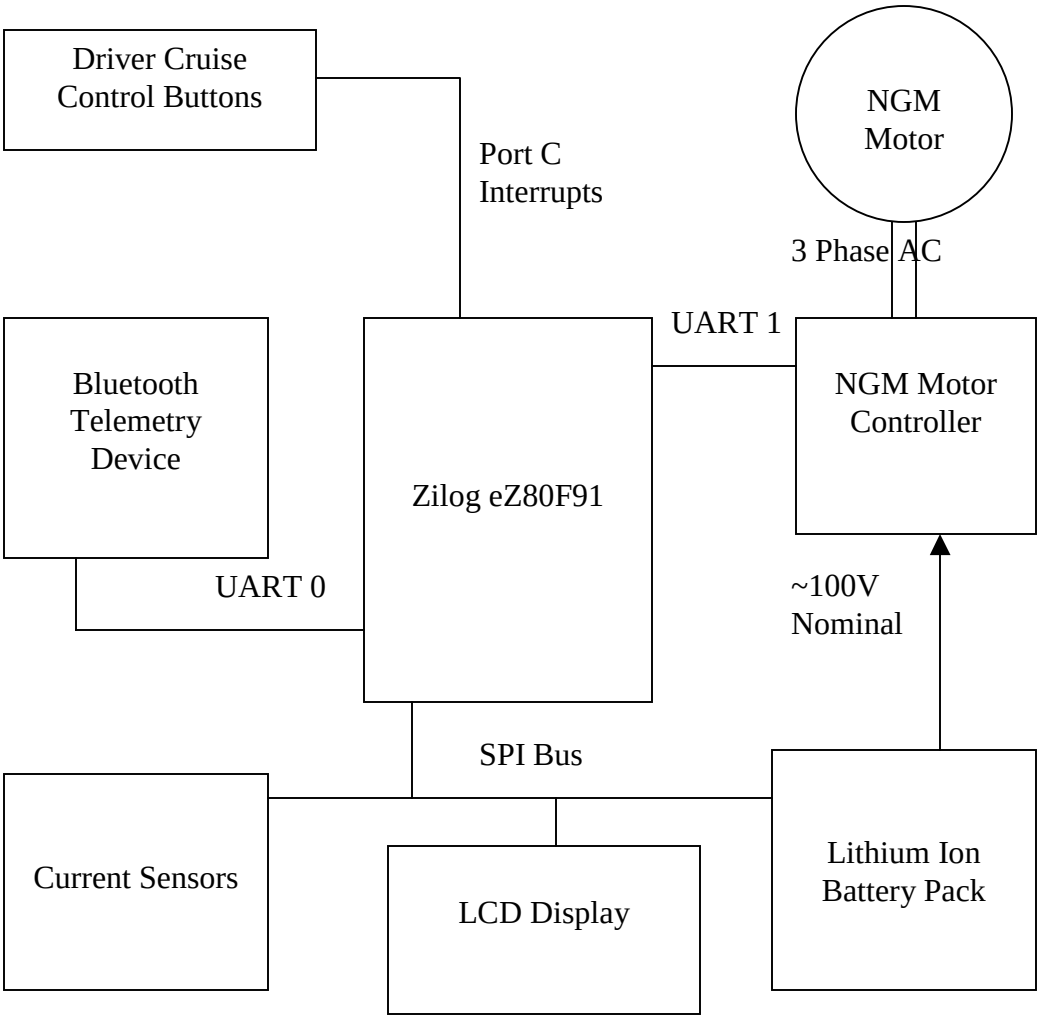
Abstract

A system for controlling the electrical aspects of a solar-powered car is presented. These vehicles use power from the sun to charge a large battery and run a very high efficiency motor. A typical car will make over 1200 watts and can drive on normal highways at speeds over 65 MPH. The system will be installed on a solar car and will serve several purposes. This system will be used to control our car for several races in the upcoming months.

There are five main features of this electrical system. The Zilog microcontroller runs an LCD display to show the driver status information. It also communicates with a bluetooth device to send similar data wirelessly to a laptop, so the team can run efficient strategy during a race. In addition, the system monitors the energy coming from the solar array, going to the motor, and in and out of the battery pack to track the amount of power available for racing. The microcontroller also interacts with a motor controller, regulating the vehicle's speed for cruise control. Finally, due to the volatile nature of the Lithium Ion batteries that are used on the car, the microcontroller will monitor the voltage and temperature of every battery and disconnect the battery pack if any cell goes out of safe operating conditions.

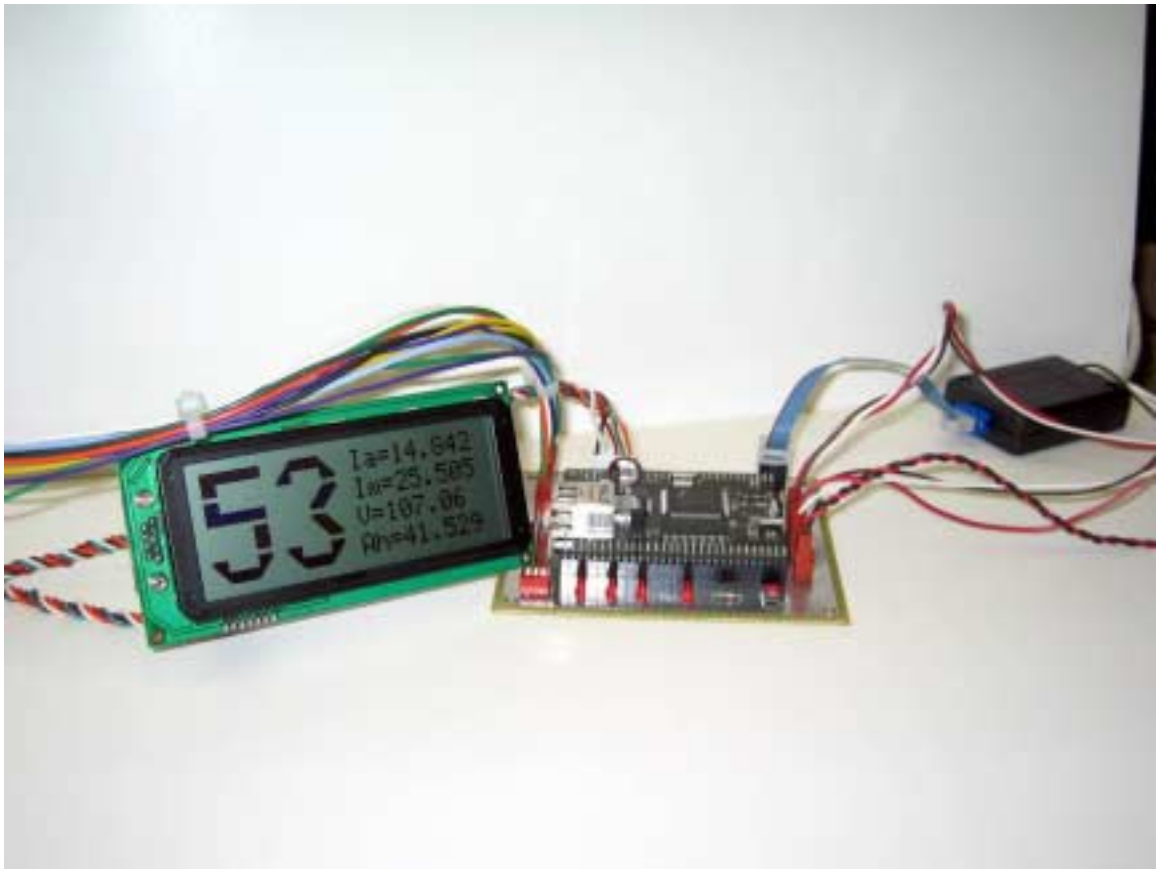
Because timing is critical in our system, everything is interrupt-driven. The most frequently used interrupts are for two serial ports and an SPI bus. Less frequently used interrupts are primarily used for driver-operated controls, such as cruise control. The code was written entirely from scratch to minimize overhead from unneeded functions and variables. To save time and code space, none of the standard libraries are used, and all floating point values are stored as 24 bit integers.

The highest priority on this project was to make it as reliable as possible. The other two important factors are that it must be lightweight and use very little power. To help keep the system reliable, the system is tested on the bench for hundreds of hours before it will be allowed on the car. In case of failure, there will be several backup units at all times to make sure that system downtime is minimized. During a solar car race, we will swap out any problem components immediately to stay off the side of the road. Problems will be addressed at night when the team is not busy racing.



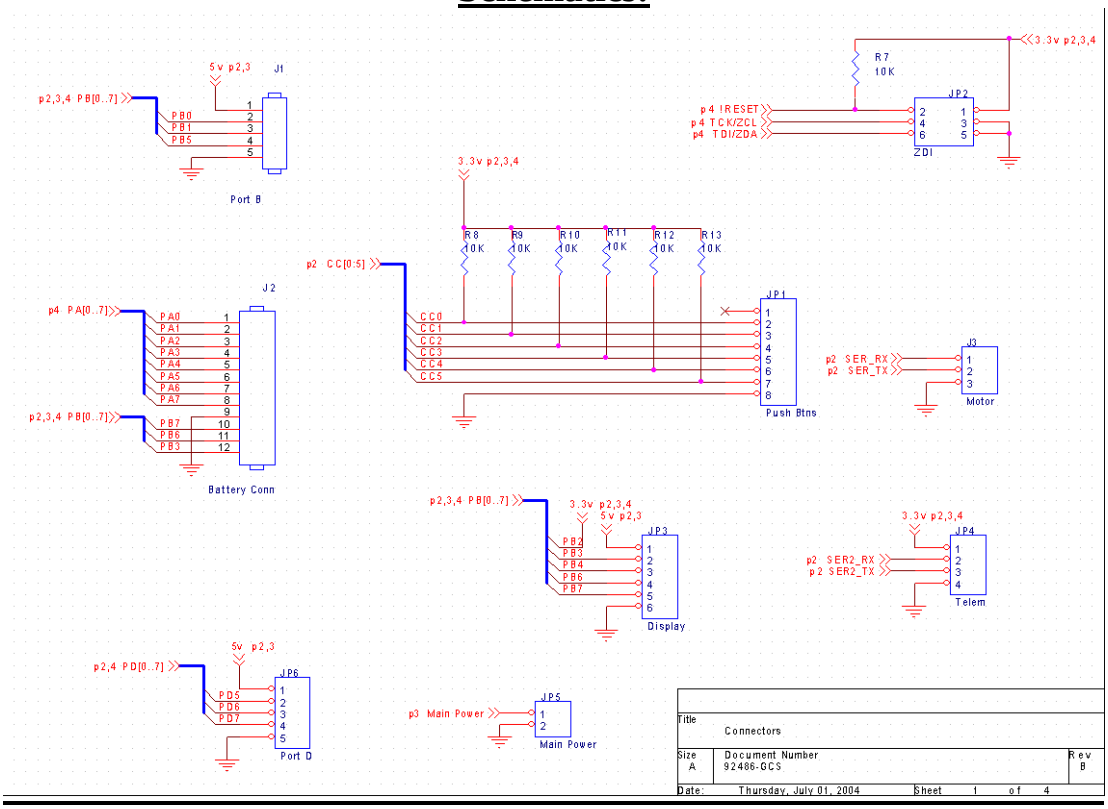
Solar-Powered Car Control System Block Diagram

The LCD Display

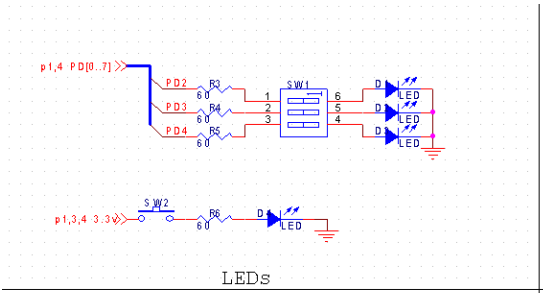


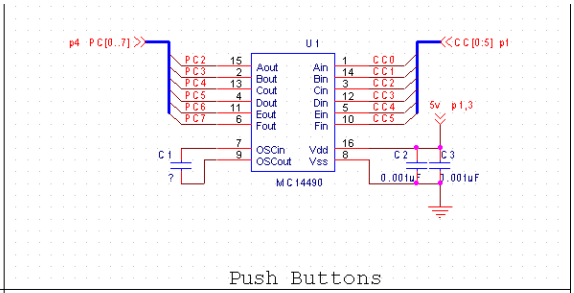
The Board and LCD

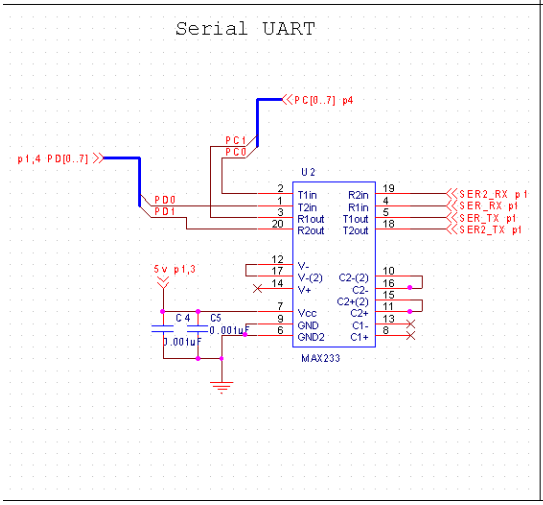
Schematics:

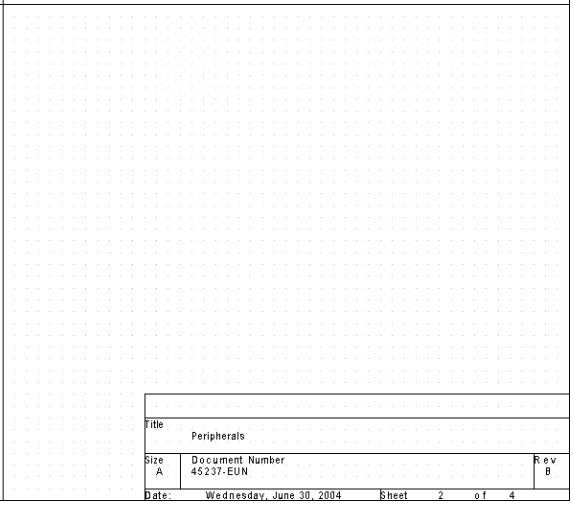


Connectors

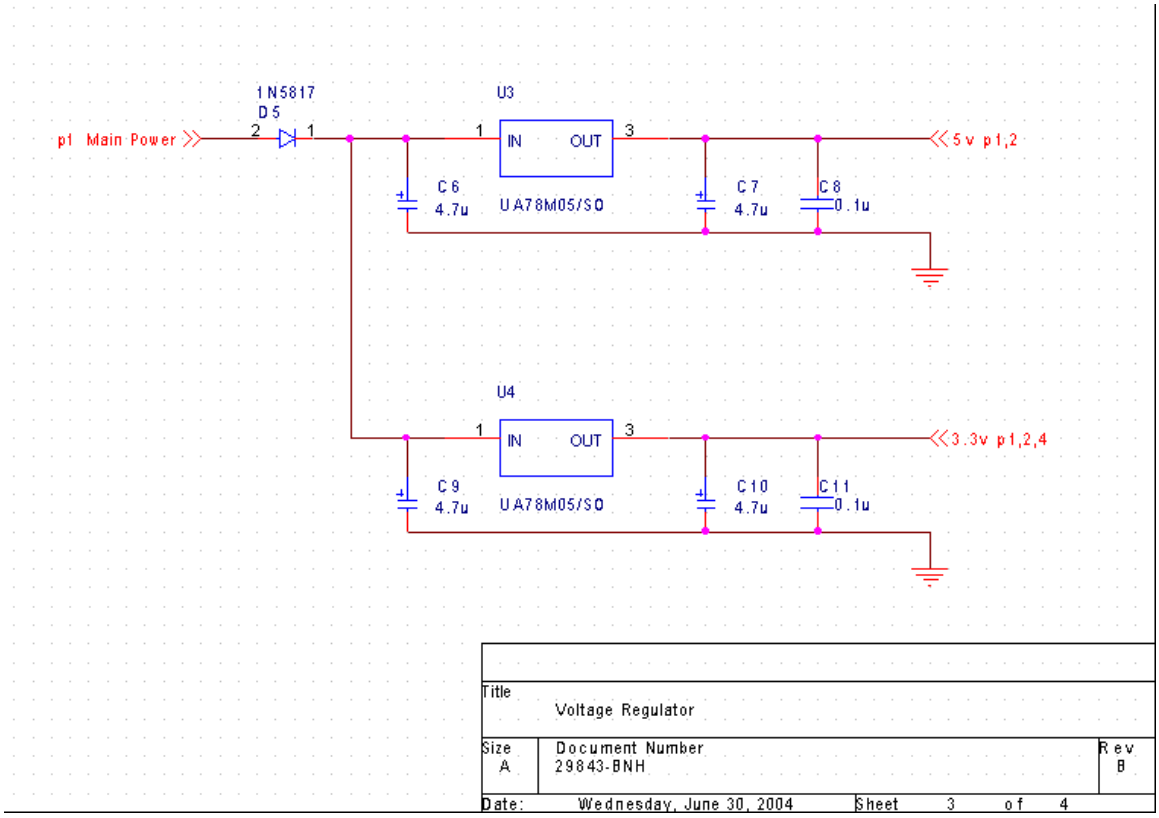




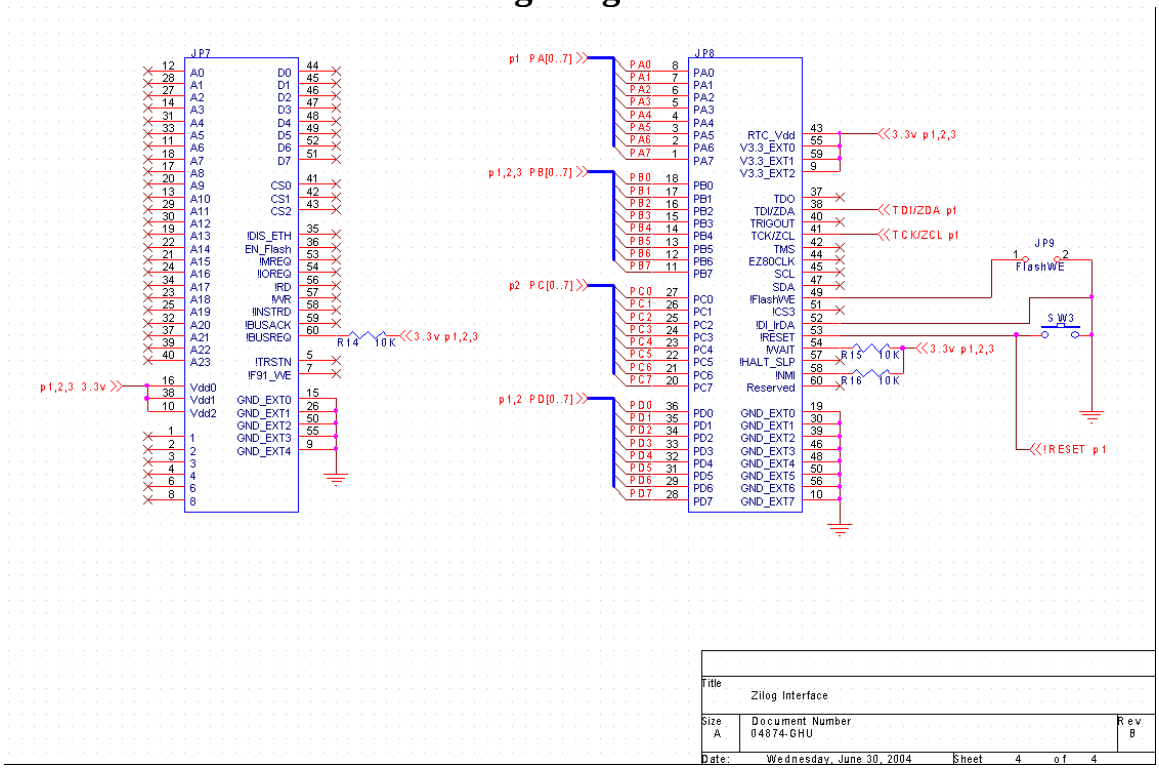




Peripherals



Voltage Regulators



Zilog eZ80F91 Microcontroller